

What is claimed is:

1 1. A tracking servo operating method comprising:
2 applying a beam spot on an optical disk on which a track
3 is formed;
4 receiving feedback light from said optical disk by a light
5 receiving unit, which is equipped with a multi-divided
6 photodetector comprising a first photo- detecting portion and a
7 second photo-detecting portion being mounted in a manner so as
8 to be divided right and left relative to a circumferential
9 direction of said optical disk, receive feedback light from said
10 optical disk; and
11 controlling an actuator through a driver so that a servo
12 operation in which said beam spot tracks said track is performed
13 according to an output from said light receiving unit;
14 wherein control is so exerted that a high frequency
15 differential signal is produced by calculating a difference
16 between a first high frequency signal obtained by having said
17 first photo-detecting portion receive first feedback light from
18 said optical disk and a second high frequency signal obtained by
19 having said second photo-detecting portion receive second
20 feedback light from said optical disk and that, after a tracking
21 error signal has been produced based on, at least, the produced
22 high frequency differential signal, the produced tracking error
23 signal is binarized and a tracking error edge signal indicating
24 an edge of rising and falling of the binarized tracking error
25 signal is extracted and that said first and second high frequency
26 signals are binarized and, when the binarized first and second
27 high frequency signals are at a specified same level, an operation

28 of pulling in a tracking servo is performed in response to said
29 tracking error edge signal.

1 2. The tracking servo operating method according to Claim 1,
2 wherein setting is made so that said tracking error signal becomes
3 0 (zero) when said beam spot is positioned at a center of said
4 track.

1 3. The tracking servo operating method according to Claim 1,
2 wherein setting is made so that said tracking error edge signal
3 is extracted when said beam spot has reached either of a center
4 of said track or a center of a region between the two tracks
5 adjacent to each other.

1 4. The tracking servo operating method according to Claim 1,
2 wherein control is exerted so that, after a band of each of said
3 first and second high frequency signals has been filtered, the
4 filtered signals are binarized and, when both the binarized first
5 and second high frequency signals are at a low level, an operation
6 of pulling in a tracking servo is performed in response to said
7 tracking error edge signal.

1 5. The tracking servo operating method according to Claim 1,
2 wherein each of said first and second photo-detecting portions
3 each are further divided into a front photo-detecting portion and
4 a rear photo-detecting portion along the circumference direction
5 of said track, and wherein said first and second high frequency
6 signals each are obtained by adding a front output signal from
7 said front photo-detecting portion and a rear output signal from

8 said rear photo-detecting portion.

1 6. The tracking servo operating method according to Claim 1,
2 wherein movement of said beam spot by said actuator is
3 accomplished by movement of an objective lens in a light source.

1 7. The tracking servo operating method according to Claim 1,
2 wherein said light receiving unit further comprises a first
3 sub-photodetector mounted in a position being isolated left by
4 $1/2$ pitches of said track in a direction of crossing said track
5 from a center of said multi-divided photodetector and comprising
6 a first left photo-detecting portion and a first right photo-
7 detecting portion mounted in a manner so as to be divided right
8 and left relative to a circumferential direction of said optical
9 disk and a second sub-photodetector mounted in a position being
10 isolated right by $1/2$ pitches of said track in a direction of
11 crossing said track from a center of said multi-divided
12 photodetector and comprising a second left photo-detecting
13 portion and a second right photo-detecting portion mounted in a
14 manner so as to be divided right and left relative to the
15 circumferential direction of said optical disk, and hereby being
16 so configured as to receive feedback light of a sub-beam from said
17 optical disk, said sub-beam being obtained by dividing a beam
18 output from a light source and to obtain a first detecting signal
19 by adding signals output from said first and second left
20 photo-detecting portions in said first and second sub-
21 photodetectors and a second detecting signal by adding signals
22 output from said first and second right photo-detecting portions
23 in said first and second sub-photodetectors, and to produce a

24 sub-differential signal by calculating a difference between the
25 obtained first detecting signal and the obtained second detecting
26 signal, and then to produce said tracking error signal based on
27 a difference between the produced sub-differential signal and
28 said high frequency differential signal.

1 8. The tracking servo operating method according to Claim 1,
2 wherein each of said first and second photo-detecting portions
3 each are further divided into a front photo-detecting portion and
4 a rear photo-detecting portion along the circumference direction
5 of said track, and wherein said first and second high frequency
6 signals each are obtained by adding a front output signal from
7 said front photo-detecting portion and a rear output signal from
8 said rear photo-detecting portion, and furthermore,

9 wherein said light receiving unit further comprises a first
10 sub-photodetector mounted in a position being isolated left by
11 $1/2$ pitches of said track in a direction of crossing said track
12 from a center of said multi-divided photodetector and comprising
13 a first left photo-detecting portion and a first right photo-
14 detecting portion mounted in a manner so as to be divided right
15 and left relative to a circumferential direction of said optical
16 disk and a second sub-photodetector mounted in a position being
17 isolated right by $1/2$ pitches of said track in a direction of
18 crossing said track from a center of said multi-divided
19 photodetector and comprising a second left photo-detecting
20 portion and a second right photo-detecting portion mounted in a
21 manner so as to be divided right and left relative to the
22 circumferential direction of said optical disk, and hereby being
23 so configured as to receive feedback light of a sub-beam from said

24 optical disk, said sub-beam being obtained by dividing a beam
25 output from a light source and to obtain a first detecting signal
26 by adding signals output from said first and second left
27 photo-detecting portions in said first and second sub-
28 photodetectors and a second detecting signal by adding signals
29 output from said first and second right photo-detecting portions
30 in said first and second sub-photodetectors, and to produce a
31 sub-differential signal by calculating a difference between the
32 obtained first detecting signal and the obtained second detecting
33 signal, and then to produce said tracking error signal based on
34 a difference between the produced sub-differential signal and
35 said high frequency differential signal.

1 9. A tracking servo apparatus comprising:
2 a light source to apply a beam spot on an optical disk on
3 which a track is formed;
4 a light receiving unit having a multi-divided photodetector
5 comprising a first photo-detecting portion and a second
6 photo-detecting portion being mounted in a manner so as to be
7 divided right and left relative to a circumferential direction
8 of said optical disk to produce a first high frequency signal by
9 having said first photo-detecting portion receive first feedback
10 light from said optical disk and a second high frequency signal
11 by having said second photo-detecting portion receive second
12 feedback light from said optical disk and to produce a high
13 frequency differential signal by calculating a difference between
14 the produced first high frequency signal and the produced second
15 high frequency signal and to produce a tracking error signal based
16 on, at least, the produced high frequency differential signal;

17 a controlling unit to binarize said tracking error signal
18 fed from said light receiving unit and to extract a tracking error
19 edge signal indicating an edge of rising and falling of the
20 binarized tracking error signal and, after having filtered a band
21 of each of said first and second high frequency signals fed from
22 said light receiving unit, to binarize the filtered signals and
23 to produce, when the binarized first and second high frequency
24 signals are at a specified same level, a control signal to start
25 a servo operation in response to said tracking error edge signal;
26 a driver to produce a driving signal according to said
27 control signal; and
28 an actuator to move said beam spot according to said driving
29 signal fed from said driver,
30 wherein control is exerted so that an operation of pulling
31 in a tracking servo is performed in response to said tracking error
32 edge signal.

1 10. The tracking servo operating method according to Claim 9,
2 wherein setting is made so that said tracking error signal becomes
3 0 (zero) when said beam spot is positioned at a center of said
4 track.

1 11. The tracking servo operating method according to Claim 9,
2 wherein setting is made so that said tracking error edge signal
3 is extracted when said beam spot has reached either of a center
4 of said track or a center of a region between the two tracks
5 adjacent to each other.

1 12. The tracking servo apparatus according to Claim 9, wherein

2 control is exerted so that, after a band of each of said first
3 and second high frequency signals has been filtered, the filtered
4 signals are binarized and, when both the binarized first and
5 second high frequency signals are at a low level, an operation
6 of pulling in a tracking servo is performed in response to said
7 tracking error edge signal.

1 13. The tracking servo operating apparatus according to Claim
2 9, wherein each of said first and second photo-detecting portions
3 each are further divided into a front photo-detecting portion and
4 a rear photo-detecting portion along the circumference direction
5 of said track, and wherein said first and second high frequency
6 signals each are obtained by adding a front output signal from
7 said front photo-detecting portion and a rear output signal from
8 said rear photo-detecting portion.

1 14. The tracking servo apparatus according to Claim 9, wherein
2 movement of said beam spot by said actuator is accomplished by
3 movement of an objective lens in said light source.

1 15. The tracking servo operating method according to Claim 9,
2 wherein said light receiving unit further comprises a first
3 sub-photodetector mounted in a position being isolated left by
4 $1/2$ pitches of said track in a direction of crossing said track
5 from a center of said multi-divided photodetector and comprising
6 a first left photo-detecting portion and a first right photo-
7 detecting portion mounted in a manner so as to be divided right
8 and left relative to a circumferential direction of said optical
9 disk and a second sub-photodetector mounted in a position being

10 isolated right by $1/2$ pitches of said track in a direction of
11 crossing said track from a center of said multi-divided
12 photodetector and comprising a second left photo-detecting
13 portion and a second right photo-detecting portion mounted in a
14 manner so as to be divided right and left relative to the
15 circumferential direction of said optical disk, and hereby being
16 so configured as to receive feedback light of a sub-beam from said
17 optical disk, said sub-beam being obtained by dividing a beam
18 output from a light source and to obtain a first detecting signal
19 by adding signals output from said first and second left
20 photo-detecting portions in said first and second sub-
21 photodetectors and a second detecting signal by adding signals
22 output from said first and second right photo-detecting portions
23 in said first and second sub-photodetectors, and to produce a
24 sub-differential signal by calculating a difference between the
25 obtained first detecting signal and the obtained second detecting
26 signal, and then to produce said tracking error signal based on
27 a difference between the produced sub-differential signal and
28 said high frequency differential signal.

1 16. The tracking servo operating method according to Claim 9,
2 wherein each of said first and second photo-detecting portions
3 each are further divided into a front photo-detecting portion and
4 a rear photo-detecting portion along the circumference direction
5 of said track, and wherein said first and second high frequency
6 signals each are obtained by adding a front output signal from
7 said front photo-detecting portion and a rear output signal from
8 said rear photo-detecting portion, and furthermore,
9 wherein said light receiving unit further comprises a first

sub-photodetector mounted in a position being isolated left by 1/2 pitches of said track in a direction of crossing said track from a center of said multi-divided photodetector and comprising a first left photo-detecting portion and a first right photo-detecting portion mounted in a manner so as to be divided right and left relative to a circumferential direction of said optical disk and a second sub-photodetector mounted in a position being isolated right by 1/2 pitches of said track in a direction of crossing said track from a center of said multi-divided photodetector and comprising a second left photo-detecting portion and a second right photo-detecting portion mounted in a manner so as to be divided right and left relative to the circumferential direction of said optical disk, and hereby being so configured as to receive feedback light of a sub-beam from said optical disk, said sub-beam being obtained by dividing a beam output from a light source and to obtain a first detecting signal by adding signals output from said first and second left photo-detecting portions in said first and second sub-photodetectors and a second detecting signal by adding signals output from said first and second right photo-detecting portions in said first and second sub-photodetectors, and to produce a sub-differential signal by calculating a difference between the obtained first detecting signal and the obtained second detecting signal, and then to produce said tracking error signal based on a difference between the produced sub-differential signal and said high frequency differential signal.

1 17. A tracking servo apparatus comprising:

2 a light source to apply a beam spot on an optical disk on

3 which a track is formed;

4 a light receiving means having a multi-divided
5 photodetector comprising a first photo-detecting portion and a
6 second photo-detecting portion being mounted in a manner so as
7 to be divided right and left relative to a circumferential
8 direction of said optical disk to produce a first high frequency
9 signal by having said first photo-detecting portion receive first
10 feedback light from said optical disk and a second high frequency
11 signal by having said second photo-detecting portion receive
12 second feedback light from said optical disk and to produce a high
13 frequency differential signal by calculating a difference between
14 the produced first high frequency signal and the produced second
15 high frequency signal and to produce a tracking error signal based
16 on, at least, the produced high frequency differential signal;

17 a controlling means to binarize said tracking error signal
18 fed from said light receiving means and to extract a tracking error
19 edge signal indicating an edge of rising and falling of the
20 binarized tracking error signal and, after having filtered a band
21 of each of said first and second high frequency signals fed from
22 said light receiving means, to binarize the filtered signals and
23 to produce, when the binarized first and second high frequency
24 signals are at a specified same level, a control signal to start
25 a servo operation in response to said tracking error edge signal;

26 a driver to produce a driving signal according to said
27 control signal; and

28 an actuator to move said beam spot according to said driving
29 signal fed from said driver,

30 whereby control is exerted so that an operation of pulling
31 in a tracking servo is performed in response to said tracking error

32 edge signal.

1 18. An optical disk device provided with a tracking servo
2 apparatus comprising:

3 a light source to apply a beam spot on an optical disk on
4 which a track is formed;

5 a light receiving unit having a multi-divided photodetector
6 comprising a first photo-detecting portion and a second
7 photo-detecting portion being mounted in a manner so as to be
8 divided right and left relative to a circumferential direction
9 of said optical disk to produce a first high frequency signal by
10 having said first photo-detecting portion receive first feedback
11 light from said optical disk and a second high frequency signal
12 by having said second photo-detecting portion receive second
13 feedback light from said optical disk and to produce a high
14 frequency differential signal by calculating a difference between
15 the produced first high frequency signal and the produced second
16 high frequency signal and to produce a tracking error signal based
17 on, at least, the produced high frequency differential signal;

18 a controlling unit to binarize said tracking error signal
19 fed from said light receiving unit and to extract a tracking error
20 edge signal indicating an edge of rising and falling of the
21 binarized tracking error signal and, after having filtered a band
22 of each of said first and second high frequency signals fed from
23 said light receiving unit, to binarize the filtered signals and
24 to produce, when the binarized first and second high frequency
25 signals are at a specified same level, a control signal to start
26 a servo operation in response to said tracking error edge signal;

27 a driver to produce a driving signal according to said

28 control signal; and
29 an actuator to move said beam spot according to said driving
30 signal fed from said driver,
31 whereby control is exerted so that an operation of pulling
32 in a tracking servo is performed in response to said tracking error
33 edge signal.